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United States Department of Agriculture,

OFFICE OF THE SECRETARY—Circular No. 23.

AGRICULTURE IN OUR INDUSTRIES.¹

The most successful farming in our day is carried on by men of highest intelligence regarding all that pertains to the soil, the plant, the animal, and the market. The American producer from the field would not be the potent factor he is without the inventor to perfect his machinery and the carrier who transports long distances at low rates; nor would he play the part he does in the world's markets with poorer soils and less genial climates.

AGRICULTURAL EDUCATION.

A vigorous movement by Federal and State agencies is in progress to educate the young people of the farm and to make research into the wide field of science that pertains to producing the nation's food, clothing, and other necessities. Discussion has been active for a generation or more regarding the preparation of the farmer for his life work. Many educators think the farmer needs nothing beyond a common-school education. Many legislators think that money devoted to training farm people is wasted. The Federal Government has voted lands and money to educate the children of the farmer and the mechanic and has endowed institutions to make research. The States have followed the lead of the Congress, and something is being done in each of them, much is being done in some of them, to teach the sciences of agriculture. The movement among those interested is so strong that the old-fashioned educator and the hostile legislator are getting into the minority.

RESEARCH WORK.

The work of the Department in Washington and in the States is a development along new lines. Whenever a producer needs help to solve problems that are beyond his powers to cope with, if the question for solution is representative and affects conditions common to a neighborhood or State, or several States, he gets help from his State or from the Federal Government. Our research work is printed, and 13,500,000 copies of our publications are distributed annually through Members of Congress and by the Department.

The Department of Agriculture operates where the State or the individual is unable to do the work or is not equipped to do it effectually. The States, as a general proposition, are making research along lines peculiar to each. No one locality can experiment for others having different conditions. The Federal Government and the States cooperate along experimental lines in many undertakings that are best conducted by mutual agreement. The Federal Government has expert specialists in more sciences than most States have.

¹ Speech of the Secretary of Agriculture delivered before the Americus Club, Pittsburg, Pa., April 27, 1907.

DRY LAND AGRICULTURE.

We have an extensive public domain, gradually passing into private ownership, where the rainfall is light and where little of value grows because of aridity, but where plant food is abundant. Other parts of the world have such conditions where people have lived for many generations and have learned to grow crops suited to dry conditions or where crops have suited themselves to the situation. We have availed ourselves, after laborious exploration by intelligent scientists, of what these peoples in Africa and Asia have done, and introduced their crops into our dry region from Texas to the Dakotas. A wheat imported six years ago, of highly nutritive qualities, gave us over 50,000,000 bushels last year, which is now being consumed in all the cities of the East by people who do not dream that they are fed from the desert. It will increase in magnitude of yield and spread of area until our semiarid country west of the ninety-ninth meridian shall produce the most of our bread independent of irrigation.

LEGUMINOUS PLANTS.

The Reclamation Service applies water. Our problem is above the ditches. Wheat will not grow every year on the same land as grass will, either with or without rainfall or irrigation. Our Northern dry States require some leguminous plant to rotate with wheat from a dry climate and from a cold winter climate. Agriculture succeeds permanently nowhere without legumes. We found new clovers, grasses, and alfalfas on the seventieth parallel north, in Siberia, suitable to our Northwest, that will rotate with grain and avoid the necessity of summer fallowing, as is now practiced in that country. One crop in two years is poor farming.

CONTROL OF ANIMAL DISEASES.

Animal diseases properly come under Federal control, since the eradication of disease in one State is not enough. Tuberculosis is less prevalent here than in any foreign country, but it is more prevalent here than it should be, and the consumers of meat and milk will soon require its eradication. The milk of no tuberculous cow should be used for human food, and it is entirely practicable to get completely rid of it. We inspect all the meats of interstate and foreign commerce, for home and foreign trade, and without this we should be shut out of foreign markets. Beyond all peradventure, ours is the best meat consumed by any people, as no other nation takes the same care we do or goes to as much expense to secure it.

THE NATIONAL FORESTS.

We have 148,000,000 acres of national forest reserves in charge of the Department of Agriculture for preservation and use, selected from the wooded lands of the public domain. The mountains at the headwaters of the streams are Nature's first reservoirs, where trees grow to protect the undergrowth that holds the water until it percolates into the land, whence it issues in springs throughout the year. Where the trees are cut and the surface is exposed, as has occurred to such an extent, the rains wash the soil down to bedrock, into the valleys, destroying them, causing higher and higher floods after every heavy precipitation and

lowering the streams between floods, as the good people of this city have lately been experiencing. We have gone too fast and too far in denuding our mountains of their trees. Wood is becoming scarcer and dearer every year. As population increases we shall be compelled to use more acreage in its sustentation. The trees will be planted again on the watersheds, and dams will be built to hold surplus water for use in times of drought, as is done in older countries. Your rivers then will be more serviceable in summer and less dangerous in the spring time.

INSECT FRIENDS AND ENEMIES.

We have friends and enemies in the insect world. They do not observe State lines, and when introduced into any part of our country the rest of it is in danger. Our annual loss from this source is very great. Just now two insects—the gipsy moth and the brown-tail moth—are spreading over New England; and if not checked they will infest the whole country. They attack the trees on lawn, street, and forest. The most effective weapon against an insect is its parasite. We have introduced many thousands of the parasites of the insects mentioned, and they are doing their work. Our Chief Entomologist is now on his way to the Crimea for more nests of the parasites. When we are visited by an insect pest the first move is to ascertain where it came from, and then we bring in also its parasitic enemy. We travel far and wide for parasites and have to be careful not to bring in the parasites of the parasite.

Other governments are taking up this idea. There is a disease of the dromedary camels in Algeria, the principal beasts of burden in that country. The Pasteur Institute at Paris has been investigating this disease and finds that it is caused by a microscopic parasite known as a spirochæte. They have discovered also that this micro-organism is carried by certain gadflies. They have further discovered that these gadflies are killed off by certain robber flies, but that the robber flies in Algeria are not active at the exact period when the gadflies are most abundant. The man in charge of this work reported the facts to Dr. Roux, of diphtheria-toxin fame, at the head of the Pasteur Institute, who said at once, "Consult Dr. Howard, of the United States Department of Agriculture." So the Department of Agriculture was consulted, and the Pasteur Institute in Paris was informed that there is in the southern United States a large wasp, known to the people as the horse guard, which is an active destroyer of gadflies. The life history of the horse guard was well known to the Department, its exact breeding places were known, and arrangements have been made to dig up next June large quantities of the larvæ of the horse guard at the time when they are about entering the pupa or quiescent stage. They are to be carried to New Orleans and placed in charge of one of the chief stewards in the cold room of a steamer going directly from New Orleans to Havre. There they are to be met by agents of the Pasteur Institute and carried to Algeria, where it is hoped they will breed, and, as their life period is approximately that of the gadflies, they will produce such an effect upon the abundance of the gadflies as greatly to reduce the possible carriers of the dromedary disease.

THE SOIL SURVEY.

We are studying the soils of the country, their variations, composition, and conditions, the crops to which they are best adapted, and other features that have been neglected in the past. The scientists of the past have told us little that is practical about soils.

METEOROLOGY.

We have weather observations at 200 stations throughout the country, which enable us to forecast conditions in the interests of agriculture and commerce on land and water, but we have not made sufficient research into the principles that control the weather. We detect the cyclone that is coming through the Caribbean Sea and herald its arrival on our shores. We give information ahead of cold that is coming from the north. We apply what we know of the weather as no other country does, but other countries study principles more than we do, though they fail to make the practical application as widely as we. Now, however, a research station is being established near Washington. Temperature, moisture, and the air at great heights will be studied. The relations of the magnetism of the earth, the temperature of the soil, and the motions of the earth have all been shown to have a more or less intimate connection with meteorology. When all these factors are well under observation better forecasts will be the result.

PRACTICAL APPLICATION OF RESULTS.

The research work for agriculture is for immediate application. Nothing is expended for abstract science alone. Our work must have the dollar in view or we would get no dollars.

BEET SUGAR.

Ten years ago the United States made 30,000 tons of beet sugar. Last year 483,000 tons were made. The products were worth \$50,000,000. Growers of the beet were shown where seed that would produce beets rich in sugar could best be grown, how to prepare the soil, plant, cultivate, harvest, test, and what to do with the by-products. Seed is being developed that has but one germ (most beet seeds have more)—seeds that can be planted as corn is planted, cultivated without hand work, topped by machinery, and lifted by machinery. When this point is reached we shall make our own sugar with machinery from the plow to the factory. The American farmer likes to sit on a spring seat, and we must provide it for him.

DENATURED ALCOHOL.

No more coal is being made, our wood fuel is getting scarce, and the supply of mineral oils will some day cease. It is high time we were looking about for sources of light, heat, and power. Other countries are doing this. Alcohol meets the requirements, and starchy plants yield alcohol. One of our explorers last year found the Siberians at Tomsk growing a large variety of potato for the alcohol it yields. He brought back half a ton of them, which will be distributed this spring among the experiment stations. The southern cassava, yams, and sweet potatoes will yield alcohol, as will the sugar beet. Corncobs

give 11 gallons of alcohol to the ton and sweet-corn stalks 7. Many refuse plants will be used and much unmarketable fruit and vegetable matter. The farm is ready to supply heat, light, and power when other sources fail. Many localities in the West suffer for fuel in winter when storms are severe or cars are scarce. We have legislation to permit the making of alcohol without payment of taxes when mixed with something to prevent its use as a beverage—wood alcohol, perhaps. The time is surely coming when the people remote from wood, coal, or oil will arrange to grow plants rich in starch for their supply of light, heat, and power. The present inquiry is along the lines of economical production, as in all new enterprises. The cornstalks of the corn belt that are not used for fodder would make very large quantities of alcohol, which would be extracted and the refuse returned to the soil or used for feed, to maintain necessary organic matter, alcohol not being a fertilizer. The Department of Agriculture is experimenting along this line, and also with regard to new devices for burning this new fuel.

RICE.

Down on the Gulf coast is a strip of country a hundred miles wide and four or five hundred miles long. Twenty years ago this country was used mostly for cattle pasturage and could be bought for from \$1 to \$2 per acre. It was discovered that rice would grow there. The Department fostered this industry, introducing new methods and new seed. Twice we had to send our men to India, China, and Japan in order to secure new information and new varieties. Each time we got what we wanted.

Seven years ago the output of rice from this country was 250,000,000 pounds. Last year it was over 800,000,000 pounds. Texas alone now produces more than half of this amount. Thousands of farmers from the grain fields of the North have flocked to this region, and homes and entire cities have been built up as a result of this industry.

MATTING.

A wise saying has it that if we will take care of the pennies the dollars will take care of themselves. What is true of individuals is true of nations. We want to keep our money at home, wherefore we have been investigating the matting industry. Every year we send to foreign peoples \$5,000,000 of our money for the matting to cover our floors. Why not make this matting at home? To compete with the cheap labor of the Orient we must have machines for weaving the matting, and to supply the raw material we must encourage the farmers to grow it.

The matting is made from a kind of rush, a water plant, that will grow almost anywhere in this country, but especially in the South. The finest varieties of this rush have been developed abroad. We have imported these varieties and are planting them in the South and elsewhere. Machines have been devised which will enable one good American operator to weave as much matting in a day as an Oriental can weave in thirty days. Our task now is to get enough raw material to keep these machines going, and we shall have the industry started.

CAMPHOR.

Camphor in the arts and sciences and in medicine is an important product. It is made from a tree which is perfectly hardy in a large extent of our southern and western country. Why not make our camphor at home? This question the Department has asked and endeavored to answer. For years the Department has been distributing camphor-tree seed, and thousands of trees are now growing throughout the South and in the Pacific Coast States.

Two years ago a serious effort was made to develop the manufacture of camphor from these trees. By improvements in manufacturing processes satisfactory results have been accomplished, and a large manufacturing concern is now building up a camphor grove of 2,000 acres in Florida, from which it hopes to make its camphor. This firm uses over half a million dollars' worth of camphor every year. Camphor is now an oriental monopoly. We prefer the American monopoly for obvious reasons.

NITROGEN SUPPLY.

One of the greatest agricultural questions in this country is the maintenance of the fertility of the soil. One of the questions involved in this subject is the supply of nitrogen. Prophets have told us in past years that it was only a question of time when America would cease to be a grain-producing country on account of the lack of nitrogen. These prophecies have not come true, for the reason that American genius has found a way to meet the emergencies as they arise and will continue to find a way. Our chief source of nitrogen at the present time is from the various chemicals imported from foreign countries. We also gain considerable nitrogen from legumes. As a means of encouraging the production of nitrogen at home the Department is putting forth every effort to induce farmers to grow these legumes. In the South, of course, one kind of legume must be grown. In the Middle West red clover is a standard crop. These legumes gather nitrogen from the air, store it up, and give it back to the soil. Besides this method, the Department has developed a laboratory system of encouraging legumes to gather more nitrogen from the air. It takes the little organisms that grow on the roots of the legumes, handles them in the laboratory, and sends them out to the farmers, so that they can treat their seed in such a way as to induce the plants from this seed to become strenuous nitrogen collectors. The Department last year sent out over 200,000 lots of these nitrogen cultures to farmers throughout the land who wished to plant clovers, alfalfas, cowpeas, and other such crops.

COTTON.

Cotton is preeminently the money crop of this land. It is the bone and sinew of the South and, of course, means much to the North. Naturally the Department has done much work on cotton. With an annual value of over \$600,000,000, the crop is worthy of our most careful investigation.

Millions of dollars have been saved to the cotton planters through the Department's work on insects and diseases which affect the crop. Millions more, we feel confident, will be brought to the farmer through improvements in cottons by breeding and selection. The cotton has been left pretty much to take care of itself; consequently little improve-

ment has been made in the staple. The Department's experts are breeding cottons of special types for special regions. At one time it was thought that the whole important Sea Island cotton industry would be swept away by a disease. The Department's experts entered the field, developed a disease-resistant cotton by breeding and selection, and reestablished the industry. In all the South where the boll weevil is now working the Department is striving to secure varieties that will be so early as to produce crops despite the weevil. We are succeeding in this and are distributing new types of cotton superior to those already in existence, and which will mature ahead of the weevil.

One of the greatest lines of propaganda work the Department is carrying on is in the South in connection with the cotton boll weevil. When the weevil invaded the country the cotton growers were discouraged, and it was necessary to rally them. This was done by extensive systems of demonstration work. The farmer is shown how to grow cotton despite the weevil, how to rotate his crops, how to improve his land, and how to surround his home with better conditions generally. Last year the Department was working along this line with over 100,000 farmers in the States of Texas and Louisiana alone, and this year the number will be increased. These farmers are being taught how to maintain the fertility of the land by the use of legumes, to grow corn, to keep animals, and at the same time produce cotton. We are endeavoring to show them that they can produce just as much cotton on half the land now in use, devoting the other half to crops which will bring them ready money and which will not deplete the soil.

WATER CONTAMINATION.

The Department works for many other people than the farmer. In the course of its laboratory investigations it was found that the water supply of cities, when bad, could be readily improved by comparatively simple methods. In the last few years the Department has treated some of the largest reservoirs in the country, which were badly contaminated, and in all cases has been successful. The treatment consists in the application of small quantities of copper. The water is immediately rendered perfectly pure, and the copper is in such minute quantities as to be absolutely harmless.

Recently the Department sent an expert to the Canal Zone for the purpose of clearing up the water supplies there. In this tropical climate water is contaminated quickly. A few applications of this copper treatment cleared up these reservoirs and rendered the water perfectly pure.

Much of this water contamination is due to the growth of small microscopic plants, some of them green in color and others brown. Some produce bad odors in the water, and all are objectionable. It is this class of contamination that the copper treatment immediately clears away.

TRANSPORTATION OF FRUITS AND OTHER PERISHABLE CROPS.

As agriculture develops and becomes systematized the relations between the farmer and the man in the city will become more intimate. Thousands of tons of produce are grown which must be handled quickly, sent into our city markets, and disposed of. Thus have developed the great problems connected with transportation, storage, and the general handling of perishable products, such as fruits, vegetables, etc.

On the Pacific coast 30,000 carloads of oranges are produced every year, and most of these must be sent across the continent to be distributed in our eastern markets. Hundreds and thousands of carloads of these fruits are destroyed through improper handling, and hundreds and thousands of carloads of other perishable fruits, such as peaches and apples, are similarly lost through bad methods of handling. The Department is studying these questions and pointing out to the grower how he may so improve his methods as to prevent his losses, pointing out to the packer how he may handle the fruit and perishable products so as to help the grower, and pointing out to the transportation companies how they may conduct their business to the end of placing the goods in the hands of the consumer in good condition. Besides this, the Department is pushing investigations with the view of placing these choice fruits across the water in the markets of our European neighbors. Special methods must be devised for handling and shipping these long distances. We have shown how peaches may be shipped from the Southern States and placed on the Liverpool and London markets as fresh as when they were taken from the trees. Such fruits have yielded handsome profits and open the way for the clearing of our markets in times of overproduction.

AGRICULTURE A CREATIVE FORCE.

Agriculture is a creative force among our industries. The result of the farmer's work of 1906 was \$6,794,000,000, an increase of 44 per cent over the last census year. We exported in 1906, \$1,718,000,000 worth of goods of all kinds, and of this 72 per cent was grown from farms and forests. Animals and their products yielded \$323,000,000, or 19 per cent, for export after supplying the home demand. Cotton and cotton products exported were \$481,000,000, or 28 per cent; grain and products sold abroad were \$197,000,000, or 11.5 per cent; and \$113,000,000, or 6.5 per cent, was miscellaneous farm products. Forest products are 7.5 per cent of our exports. We use tobacco extensively and pay around \$30,000,000 for importations from Cuba and Sumatra, Porto Rico, Mediterranean countries, and Brazilian ports. We raised Sumatra wrappers last year to the extent of \$7,000,000 worth. The Department, after discovering principles, conducts object lessons on the farms of the people to help them toward better things. We found in the Connecticut Valley and in Florida the same soil that grows the wrapper tobacco in Sumatra, after visiting that country and studying their methods and soils. We found in Alabama and Texas the same soil that produces the filler tobacco in Cuba, after learning what soil is suitable, and last year raised 400 acres of it in those States. We hope in time to grow all the tobacco now imported from Cuba and Sumatra into the United States.



